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BAKER'S ELLIPTIC FUNCTIONS.*

The appearance, which we here record, of the first work of considerable extent devoted exclusively to Elliptic Functions published in this country is a noteworthy event. The volume before us is stated in the preface to have been compiled "in the hope of smoothing the road to this interesting and increasingly important branch of Mathematics, and of putting within reach of the English student a tolerably complete outline of the subject, clothed in simple mathematical language and methods." The author adds: "New or original methods of treatment are not to be looked for. The most that can be expected will be the simplifying of methods and the reduction of them to such as will be intelligible to the average student of Higher Mathematics."

The design is excellent. It is to be regretted, however, that the carelessness of style displayed in the last sentence quoted above more or less pervades the whole volume. It would almost seem in some places as if the author had sent his rough mathematical notes to the printer, and omitted entirely to revise the proof-sheets. The most glaring instances of this we have noticed are these: On page 14, equation (17) is followed by a line of mathematical symbols which seem to have been dropped there by pure accident. On page 63 the author, having shown that $\frac{1}{A} = \sqrt{k}$, and desiring to show that $\frac{B}{A} = B\sqrt{k}$, writes down the following intermediate step! "We have identically

$$1 = B \frac{1}{B} = B \frac{\frac{1}{A}}{\frac{1}{A}} = B \frac{\sqrt{k}}{\frac{1}{A}};$$

whence

$$\frac{B}{A} = B\sqrt{k}."$$

Aside from matters of this sort, the want of clearness of style is a serious drawback in a text-book. It by no means conduces to smoothing the road of the student, when he is allowed to puzzle himself over some statement so made as to lead him to suppose it ought to be self-evident, only to find, if he

* Elliptic Functions. An elementary text-book for students of mathematics, by Arthur L. Baker, C. E., Ph. D. 118 pages large 8vo. New York. John Wiley and Sons. 1890.

has courage to go on, that it is to form the conclusion of the argument into which he next plunges with no notion of its probable drift.

But it is more important to consider what should be the principle guiding the selection of matter in an elementary text-book upon a high mathematical subject. The decision of this point depends greatly upon the answer to a more fundamental question: How are we to regard the subject itself? Is it merely an attempt to surmount certain mathematical difficulties; to solve certain problems which may arise in the practical applications of mathematics? Or is it, on the other hand, a mathematical theory, worthy of study not only as an intellectual exercise, but for the sake of its own intrinsic beauty and symmetry?

In the lower branches we are inevitably compelled to take the former view to a great extent; the interest of the student must be aroused, if at all, by the solution of problems, the conquest of difficulties before unsurmountable. Weapons are being forged for him, he must be permitted to practise in their use, no matter how fantastical the enemies which are set up to be demolished by him.

This spirit is frequently carried too far, even in the preparation of treatises on the lower branches; and there is a tendency to introduce it into the higher subjects, where it is quite out of place, even in an elementary treatise. The effect is to overload the subject with matters which can be made to wear a practical look, thus sacrificing space which would have been used to far greater advantage, both in point of benefit and interest to the student, in giving at least an outline of the theory.

It seems to us Prof. Baker makes the mistake just indicated. Thus a great portion of his book is given up to the very dreary subject of the reduction of integrals to the standard elliptic forms, and a large space to Landen's Transformation and to numerical computations based upon the resulting formulæ. On the other hand, when the double periodicity is reached, the author says (having, however, stopped short of the equations which actually exhibit the imaginary period): "We see from what has preceded that Elliptic Functions have two periods, one a real period, and one an imaginary period. In the former characteristic they resemble Trigonometric Functions, and in the latter Logarithmic (? Exponential) Functions. On account of these two periods they are often called Doubly Periodic Functions. Some authors make this double periodicity the starting-point of their investigations. This method of investigation gives some very beautiful results and processes, but not of a kind adapted for an elementary work."

It is true that most mathematical theories have arisen from the attempt to surmount practical difficulties, and the consideration of these difficulties frequently suggests the most interesting method (largely because it is the historic method) of approaching the theory. For example, elliptic functions grew out of the attempt to perform integrations of an order transcending those which had already been accomplished. It does not follow that an elementary treatment of the subject should be subordinated to the consideration of these practical difficulties ; nor, on the other hand, is it true that the theory which arose out of these attempts can only be properly developed by abandoning the historic point of departure. X.